Utility System Management: Migration from CAD to GIS

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Background

The Japanese islands of Honshu and Kyushu are home to numerous U.S. military installations. PWC Yokosuka has designed its GIS to be "portable" across the public works corporation in order to support multiple installations (technical details available upon request).

GIS Management

PWC Yokosuka's GIS staff consists of one government employee and two Japanese nationals. Data maintenance is performed by functional users that use the data on a daily basis, thus freeing the GIS staff to focus on technology issues.

The Basemap—Foundation of All Data

GIS implementation is centered on the installation basemap. The first priority for each installation is to develop a spatially accurate map and establish data maintenance processes.

CAD-Centric Mindset

PWC Yokosuka had been using AutoCAD for several years. We needed a solution where CAD and GIS environments could coexist.

We selected ArcCAD as the GIS editing tool. Features that did not require GIS functionality continue to reside in AutoCAD. ArcView GIS is used to assemble data from coverages and drawings into the composite installation map.

The Data Migration Process

Prior to GIS, CAD files were available for the following systems:

- Electrical
- Potable water
- Steam supply/return
- Compressed air
- Saltwater

Most of the existing data was registered to an outdated, spatially inaccurate CAD map and was far from topologically correct. Our plan for this data was to

1. Reregister the data to the new, accurate installation map.
2. Rename and relayer files based on Tri-Service Spatial Data Standards (TSSDS).
3. Use ArcCAD® and ArcInfo™ software for data cleanup, attribute assignment, and topology creation.
4. Make data accessible to users via ArcView GIS.
5. Survey all visible utility features to improve the accuracy of the utility distribution data.

Reregister the Data

The existing data was categorized in three ways. Freshwater was in a local base coordinate system with an artificial origin, affectionately known as the "twilight zone." Other drawings were based on an older, spatially inaccurate basemap ("pretwilight"). Its coordinates were in millimeters and rotated to satisfy legacy plotting requirements. This required extensive rubber sheeting to correct localized distortions. The third category of legacy data was hard copy.

First, we needed to correct spatial relationships and convert all data to Tokyo datum, Zone 9. This created relationships between legacy data and data collected by GPS or electronic total station (ETS) equipment.

We used the permanent survey benchmarks to move and rotate the twilight zone drawings. After testing the moved data against known survey points, we found it highly accurate (+/- ½ meter).

In contrast, the pretwilight data was exceptionally distorted. To correct legacy data, we created links between the building centroids of the pretwilight data and the Zone 9 centroids. Centroids were used to minimize the impact of building footprint rotation.

Both of these processes were short-term measures. The five-year goal is to survey all visible utility features and update the legacy data to true measured locations.

Improve Utility Data to Survey Quality

We proposed a five-year engineering survey of the visible features within the Yokosuka base. Our goal is to further update underground data as construction projects are performed (i.e., be there when the ground is torn up).

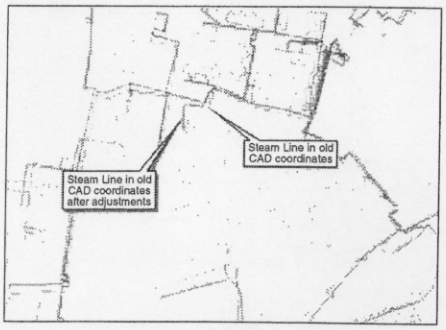
Although PWC Yokosuka has GPS, we experienced operational difficulties from hilly terrain and faulty WGS84 to Tokyo Zone 9 software projection. Therefore, we decided to purchase an ETS for the PWC engineering survey team. Our goal was to survey all utility features in a given area, covering all features in a single survey pass of the base.

We developed a total station data import application—the CAFM Field Collection Planning extension. This application (a) reads the survey data, (b) imports it into ArcView GIS themes, and (c) exports these themes to DXF files.

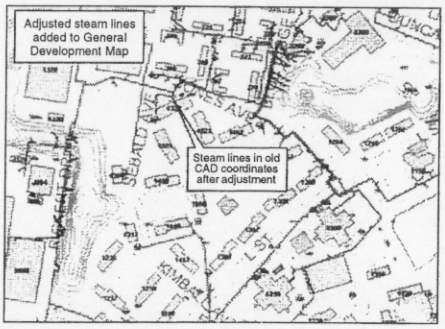
The user imports the DXF files into AutoCAD, creating blocks with attributes for the survey points. Customized ArcCAD routines adjust the existing utility features to the verified locations. The metadata history of each feature is also recorded as coverage attributes.

Conclusion

PWC Yokosuka is committed to making GIS technology an integral part of our public works support for the U.S. Navy. With the addition of utility information, the value of our system has increased significantly.



This graphic shows how an adjustment works on linear features such as steam lines.



Adjusted steam lines implemented into the General Development Map.

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